DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Forest Products Research Laboratory Leaflet No. 4

Revised April, 1963

The Death-Watch Beetle

Description

The death-watch beetle, *Xestobium rufovillosum*, is a member of the family Anobiidae (furniture beetles) and is well known on account of the damage it causes to the woodwork of our historic buildings such as cathedrals, parish churches and manor houses. It is widely distributed in England and Wales and occurs in Ireland but is less frequent in the North, and there is no record of its occurrence in Scotland. The name " death-watch " is derived from the tapping sounds produced by the adults of both sexes during the mating period—March to June. This tapping is intermittent, 6-8 rapid taps being repeated at short intervals, and differs from the sound produced later in the year by book lice (Psocids) which more closely resembles the ticking of a watch.

The beetle (Fig. 1), the largest of the British Anobiids, is $\frac{1}{4}$-$\frac{1}{3}$ in. (6-9 mm) in length. Chocolate brown in colour, it is coated with patches of short yellowish

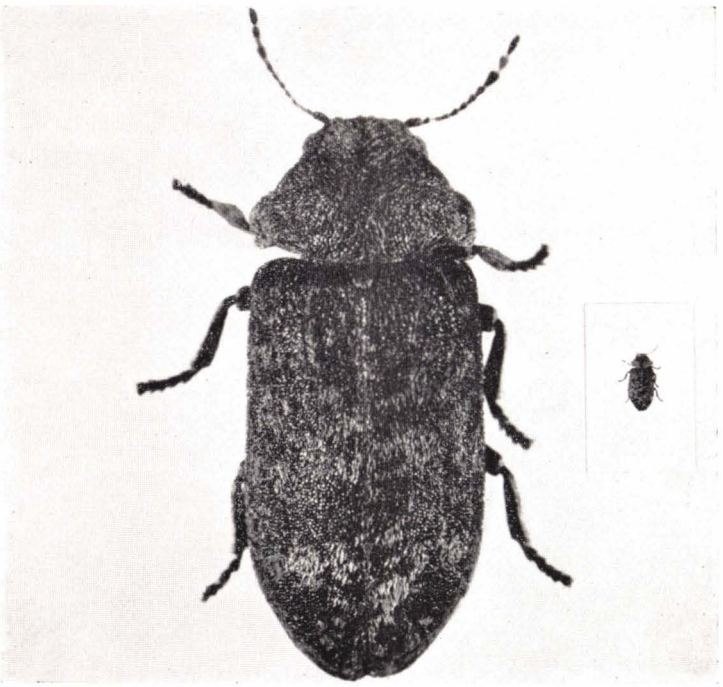


Fig. 1. The death-watch beetle, *Xestobium rufovillosum* (× 10).
Inset : natural size.

hairs, giving a variegated appearance tending to camouflage the beetle when on the surface of old wood (Fig. 2). The fully grown larva (Fig. 3) is slightly larger than the beetle and is curved, whitish and covered with long fine yellow hairs ; it has a yellow-brown head bearing a pair of dark brown jaws.

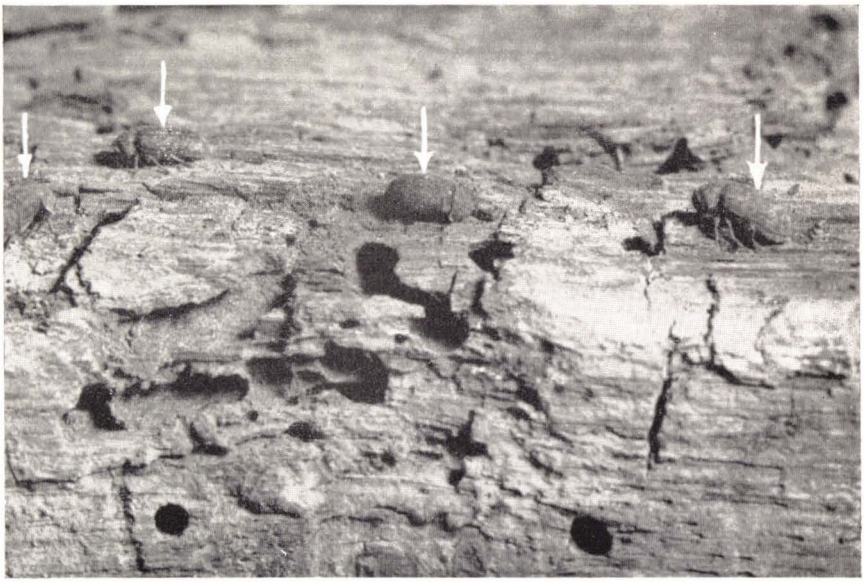


Fig. 2. Death-watch beetles on surface of decayed oak (×2)

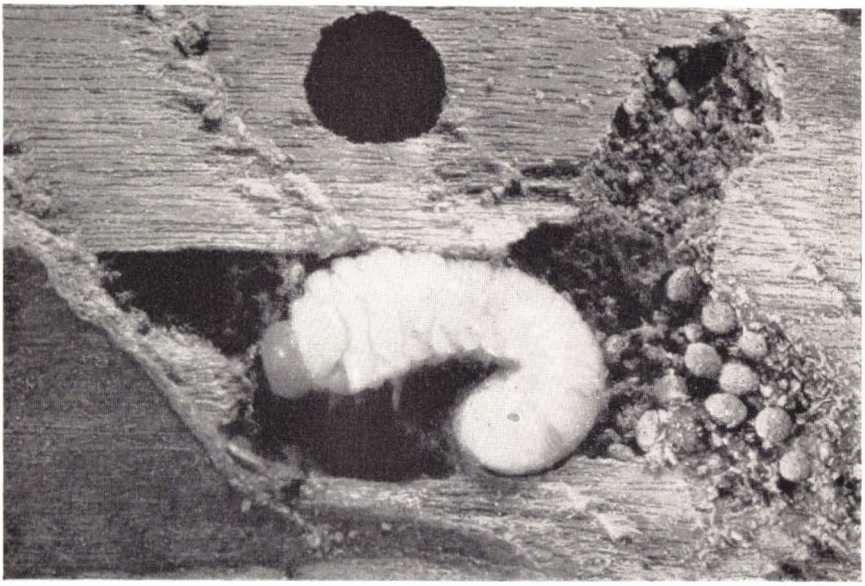


Fig. 3. Larva of the death-watch beetle in tunnel (×6)

Life History

The duration of the life-cycle (egg to emergence of adults) varies considerably, depending on the amount of sapwood and extent of fungal decay as well as on temperature and the moisture content of the wood. Under experimental conditions the life-cycle can be completed in one year, but in buildings this may take from five to ten years or more, largely depending on the extent of fungal decay in the wood.

The beetles bore their way out of infested wood between the end of March and beginning of June and after mating lay their eggs—usually 40 to 60 but occasionally up to 200 per female—in cracks and crevices on the surface of wood or within old tunnels and flight holes. The white, lemon-shaped eggs measure approximately $\frac{1}{40}$ in. (0.6 mm) in length and normally hatch in about five weeks. The newly emerged larvae wander over the surface of the timber before commencing to bore into the wood where they feed and grow, often causing severe damage since they frequently penetrate deeply into the heartwood (Fig. 4). When the larva is fully grown, it changes into a pupa (chrysalis) in July or August, and two or three weeks later the pupa, in turn, changes into a beetle which remains within the wood until the spring of the following year when it emerges, making a round flight (or exit) hole about $\frac{1}{8}$ in. (3 mm) diameter on the surface of the timber.

The predacious beetle, *Korynetes caeruleus*, is often present in wood infested by the death-watch beetle, particularly in cases of long-standing attack. About $\frac{1}{4}$ in. (6 mm) long and metallic blue, it emerges from attacked wood at the same time as the death-watch beetle, but is much more active. It does not damage timber but the grubs of this useful insect feed upon the larvae of the death-watch beetle in their tunnels ; however, the effect of this predator on the death-watch beetle population does not appear to be great.

No evidence exists to support the belief that either incense or bats have any effect on the progress of attack by the death-watch beetle.

Damage caused and Recognition of Attack

In its natural habitat the death-watch beetle causes unimportant damage in decayed parts of oak, willow, hawthorn and other hardwood trees. In old buildings however, deep-seated injury is frequently caused to hardwoods, generally oak—the timber most commonly used ; damage has also been recorded in alder, beech, chestnut, elm and walnut. Although little is known of the susceptibility of tropical hardwoods, their resistance to fungal decay—the principal factor determining the susceptibility of timber to death-watch beetle attack—should provide an indication of their suitability for structural woodwork in situations where there is a risk of infestation. Softwoods (conifers) appear to be attacked only when they are in contact with or near to infested hardwoods.

Attack is almost entirely confined to decayed timber which either was installed in an unseasoned condition or has become re-wetted in use. In many cases, attack was probably introduced at the time of erection by using timber obtained from naturally infested trees or from demolished buildings. The combined effect of death-watch beetle and fungal decay in heartwood often produces severe structural damage. The decay may be slight or no longer active and in such cases the death-watch beetle is the primary pest. The most serious death-watch beetle damage usually occurs in built-in parts of timbers such as

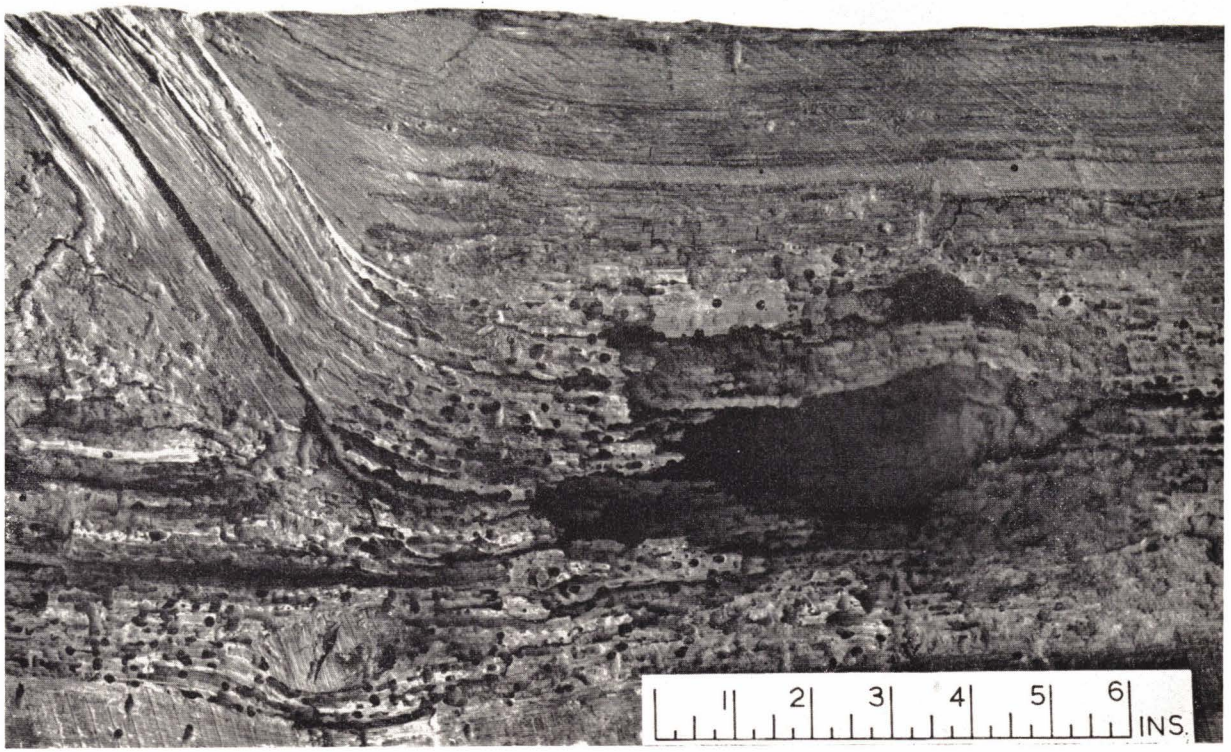


Fig. 4. Damage by the death-watch beetle exposed at the centre of old structural timber.

tie beams, wall plates, floor joists, bond timbers and lintels, where ventilation is poor and where moist masonry or defective roof coverings may result in fungal decay. When flight holes are present on the surface of the wood, damage is often visible on superficial examination, but where the attack is internal it may not be obvious. Infestation also occurs in pews and screens but is rarely found in chairs or other small articles of furniture.

The closely related common furniture beetle or " woodworm ", *Anobium punctatum*, is also found in old buildings, often in the same timbers as the death-watch beetle, but is of much less structural importance. The two types of infestation can be distinguished by the size of the flight holes and the texture of the bore dust.

	Timbers attacked	Flight holes	Bore dust
Death-watch beetle	Decayed hardwoods, e.g. oak, chestnut, elm, etc. Softwoods rarely. In heartwood and sapwood.	Circular. Approximately $\frac{1}{8}$ in. (3 mm) diameter (Fig. 5a).	Coarse. Contains bun-shaped pellets. (Fig. 5b).
Common furniture beetle	Hardwoods and softwoods ; sound but sometimes decayed. Usually sapwood only.	Circular. Approximately $\frac{1}{16}$ in. (1.5 mm) diameter. (Fig. 5a).	Finer. Contains small ellipsoid pellets (Fig. 5b).

Survey of Buildings

In a building where death-watch beetle damage is suspected, a thorough survey by a competent authority should be undertaken before deciding on the type and extent of treatment.* Inspection should include both the outside and the inside of the building and special care should be taken to examine all areas where there are signs of penetration of damp through faulty roof coverings, absence of damp-proof courses in parapet walls, faulty rain-pipes or guttering, settlement or other causes. Internally, the scope of an inspection is often determined by the type of roof, whether open from below or enclosed by ceilings. A limited initial examination may be sufficient to decide whether erection of scaffolding and exposure of structural timbers are necessary. In addition to roofing and flooring, other woodwork, such as pews, panelling and screens, should be inspected. The survey should have two objectives :

(a) To determine the structural condition of the timbers resulting from past attack, and

(b) To assess the extent and distribution of existing activity.

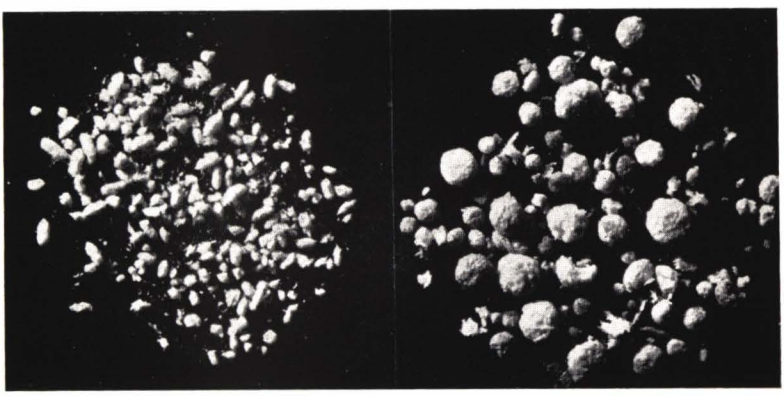
(In cases of long-standing attack (a) should receive priority).

*A list of architects experienced in the maintenance and repair of ancient buildings and churches, and of servicing firms equipped for application of insecticides and fumigation, may be obtained from the Central Council for the Care of Churches, Fulham Palace, London, S.W.6.

Assessment of Extent of Damage

The severity and distribution of damage can be assessed to some extent from the number and position of flight holes on the surface of the timbers. Where attack is deep-seated, however, drilling may be advisable to ascertain the extent of internal tunnelling, not always evident superficially. Attention should be given chiefly to members in contact with or built into walls, particularly beneath valleys between adjacent roofs, places which are vulnerable to entry of damp and onset of fungal decay. Exposure of the bearing ends of members may be necessary in either floors or roofs.

(a)



(b)

Fig. 5 (a) Flight holes of the common furniture beetle (approx. $\frac{1}{16}$ inch diam.) and the death-watch beetle (approx. $\frac{1}{8}$ inch diam.) (natural size).

(b) Bore dust ($\times 8$)
Left : The common furniture beetle.
Right : The death-watch beetle.

Evidence of Present Activity

Active attack is indicated by :

(a) presence of living beetles on or near damaged timber during the emergence period, March to June. Death-watch beetles falling from roofing timbers may be found during this time on floors and since they do not usually wander far, their numbers and distribution should be recorded as they form a useful guide to the extent of activity above. Their absence from the floor, however, does not necessarily mean that the timbers above are free from attack.

(b) the condition of the flight holes. Fresh holes are sharp in outline and the wood within fresh and bright ; dull and weathered holes are relics of earlier attack.

(c) the presence of small piles of bore dust produced by emerging beetles on or beneath infested timbers.

Remedial Treatments

Repair of damage caused by the death-watch beetle and eradication of active attack require a combination of measures based on an accurate survey of the conditions within the building : these measures may be grouped as follows :

(a) *Replacement or Strengthening*

The presence of long-established attack may call for the renewal or strengthening of structural woodwork. As a general rule sapwood, which is very susceptible to fungal decay and attack by wood-boring beetles, should be removed from new timber ; alternatively it should be thoroughly treated with a reputable preservative. Adequate treatment of oak heartwood is not practicable but provision of a damp-proof course may be desirable where continuance of damp conditions is anticipated. If softwoods are used the timber should be treated if possible by impregnation under pressure ; where this is impracticable all members should be treated superficially by dipping, brushing or spraying. In some cases certain tropical hardwoods may be used which, because of their high natural resistance to fungal decay, are unlikely to deteriorate to a condition suitable for attack by the beetle. When timber is removed from old buildings for re-use particular care should be taken to ensure that it is free from infestation. Heat sterilisation (see Forest Products Research Leaflet No. 13) or thorough insecticide treatment should be given to affected timber.

(b) *Elimination of Conditions Favouring Attack*

To eliminate the conditions favouring attack it is usually necessary to repair roof coverings, gutters, rain-pipes, insert damp-proof courses in parapet walls or remedy other structural defects which lead to the penetration and accumulation of moisture. The provision of adequate ventilation is of great importance.

(c) *Insecticide Treatment*

Insecticide treatment should be regarded as additional and not an alternative to the measures listed above. Before treatment is given the timbers should be cleaned down, disintegrated wood cut away, and bore dust removed.

There are many chemicals which kill wood-boring insects but they are effective only if the insects can be reached. Since the larvae of the death-watch

beetle often tunnel well below the surface of oak heartwood it is important to choose an insecticide with good penetrating powers. Surface application relies to a great extent upon the flight holes and tunnels to carry the liquid into the timber to reach the insects and, in the case of the death-watch beetle, it is essential to supplement brush or spray treatments by injection of the liquid through flight holes or through holes drilled for the purpose in timber where deep-seated internal damage is evident or suspected. An organic solvent type preservative is now available in the form of a mayonnaise emulsion which shows good penetrating powers.

Many proprietary preparations are suitable not only for treating existing attack (provided they reach the insects within the timber) but also for giving protection from re-infestation over long periods. Success in their use depends chiefly on the care and thoroughness with which they are applied. A single treatment cannot always be relied upon to destroy all stages of the insects within the wood and periodic examination may reveal the necessity for further treatment. Some grubs may survive a single treatment and emerge as adults through treated surfaces several years later. It is not practicable to specify the number of treatments needed or the periods over which they should be repeated. In structures where dismantling or scaffolding is necessary to reach the timber, reliance may have to be placed on a single treatment. The precise time of year for treatment is unimportant.

Where non-specialist labour is employed protective clothing (a minimum of respirator, goggles and gloves) is advisable when applying insecticides in quantity. Where inflammable solvents are used the possible fire risk should be borne in mind and due precautions taken.

(d) *Fumigation*

The use of a poisonous gas such as methyl bromide or hydrogen cyanide is not usually practicable for the treatment of structural woodwork owing to the difficulty of making the whole of a large building gas-tight or of localising the treatment. This method of control may be suitable in special cases however, for example, where there is a closed roof space or where the affected woodwork, panelling or carved figures can be dismantled and removed to fumigation chambers. Such treatment should be carried out only by specialist firms equipped for the purpose. Fumigation leaves no residual toxic deposit in the wood and may need to be repeated at intervals or to be followed by a preservative treatment.

Conclusions

Damage by the death-watch beetle is a legacy inherited with many of our ancient buildings and churches primarily due to the traditional use of large-dimension oak and other hardwoods in an unseasoned condition and probably containing incipient fungal decay and attack by this beetle. The continued development of the death-watch beetle is favoured by poor ventilation and damp conditions leading to an increase in the extent of fungal decay. The problem is not likely to arise in modern building practice and the high incidence of damage brought to light over the last thirty to forty years is due to the growing awareness of the need for proper inspection and maintenance of old buildings rather than to any sudden spread of the insect. Most infestations are of long standing and are related to the general standard of maintenance of ancient buildings, including the condition of masonry, roof coverings, gutters, etc. The structural measures

outlined above are of prime importance, but in addition direct attack upon the insects is necessary since they can thrive in wood where the degree of decay is slight and the moisture content is now too low for further fungal attack. Liquid insecticides are a valuable form of control, due to improved formulations and better techniques of application ; a new type of formulation (a mayonnaise emulsion) shows promising results in recent tests on penetration into attacked wood. Fumigation as a means of control is at present of minor importance, and although the initial effect in buildings which permit its use is likely to be greater than that of liquids, the lack of residual protection limits its value especially where complete control is not achieved. It is important that full records of treatments and repairs should be kept, e.g. by Parochial Church Councils, and that regular post-treatment inspections should be carried out so that the degree of control achieved—immediate and long term—can be assessed.

The Quinquennial Scheme for the Inspection of Churches should do much to ensure the detection of future infestations before serious damage occurs.

Further information relating to these problems may be obtained from the following publications :—

Dry Rot in Buildings. Recognition, Prevention and Cure. *Forest Products Research Laboratory Leaflet* No. 6 (Revised 1960). London, H.M.S.O. Price 1*s.* 3*d.*, by post 1*s.* 6*d.*

The Common Furniture Beetle. *Forest Products Research Laboratory Leaflet* No. 8 (Revised 1959). London, H.M.S.O. Price 1*s.* 6*d.*, by post 1*s.* 9*d.*

The Kiln Sterilization of *Lyctus*-infested Timber. *Forest Products Research Laboratory Leaflet* No. 13 (Revised 1962). London, H.M.S.O. Price 5*d.*, by post 8*d.*

Timber Decay and its Control. *Forest Products Research Laboratory Leaflet* No. 39. (Revised 1962), London, H.M.S.O. Price 1*s.* 6*d.*, by post 1*s.* 9*d.*

CROSSLEY, F. H. (1951). *Timber Building in England.* Batsford. 18*s.* 0*d.*

CAROE, A. D. R. (1949). *Old Churches and Modern Craftsmanship.* Oxford University Press. 18*s.* 0*d.*

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